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How to write a review paper

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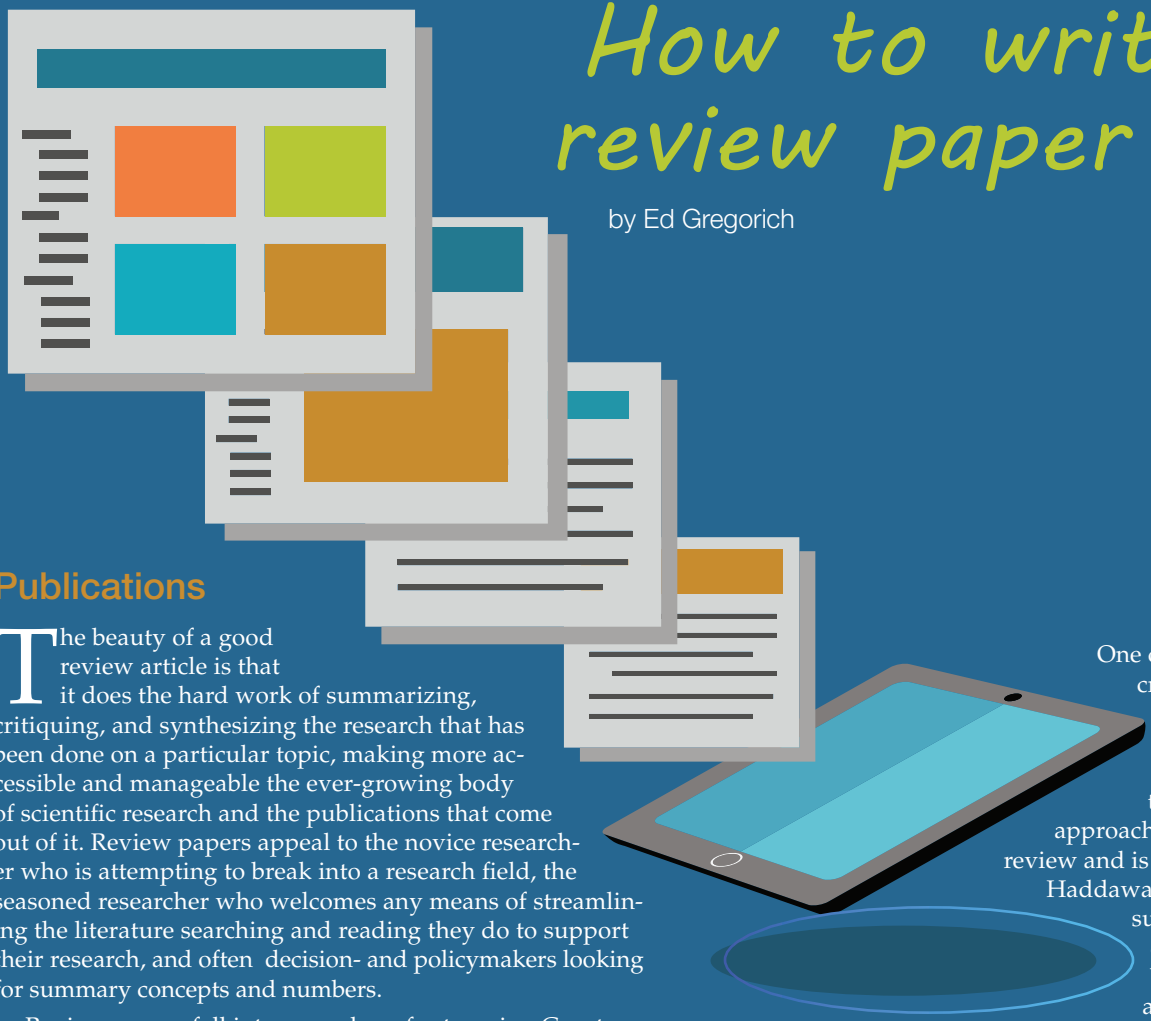

Publications

The beauty of a good review article is that it does the hard work of summarizing, critiquing, and synthesizing the research that has been done on a particular topic, making more accessible and manageable the ever-growing body of scientific research and the publications that come out of it. Review papers appeal to the novice researcher who is attempting to break into a research field, the seasoned researcher who welcomes any means of streamlining the literature searching and reading they do to support their research, and often decision- and policymakers looking for summary concepts and numbers.

Review papers fall into a number of categories. Grant and Booth (2009) analyze 14 different review types. For example, evidence-based management systems that have moved to the forefront of environmental and medical policymaking depend heavily on systematic reviews, which are highly comprehensive; follow a strict, objective methodology; and are often based on numbers. The review type that this short article mainly describes has been termed a *critical* (Grant and Booth, 2009) or *integrative* (Torraco, 2005, 2016) literature review.

A critical or integrative review "goes beyond mere description of identified articles and includes a degree of analysis and conceptual information… [It] presents, analyzes, and synthesizes material from diverse sources" (Grant and Booth 2009, p. 93). In other words, it "reviews, critiques, and synthesizes representative literature on a topic in an integrated way such that new frameworks and perspectives on the topic are generated (Torraco, 2016, p. 404). It helps to move scientific research forward by taking stock of what has already been done, consolidating concepts and themes across various research efforts, addressing and perhaps attempting to resolve competing schools of thought, identifying research gaps, and pointing the way for future work.

One criticism of the critical or integrative review is that it may lack the objective, structured approach of the systematic review and is thus less reliable. Haddaway et al. (2014) suggest that this deficiency can be overcome by applying a greater measure of rigor to the process of writing a critical review. Achieving greater rigor involves "mitigating bias; increasing transparency, consistency, and procedural objectivity; and critically appraising the evidence" (p. 1599).

The *Journal of Environmental Quality* (JEQ) publishes reviews under the heading "Reviews and Analysis." As this heading implies, the review papers we seek move beyond a mere summary of research and are characterized by the rigor described above. Their purpose is to provide:

- a sufficient review of the literature that enables understanding and interpretation of the topic without being exhaustive, and
- a synthesis of existing knowledge along with new insights or concepts not previously presented in the literature that collectively add to our comprehension.

The reviews sought by JEQ are much more than a simple summary of what is understood about a particular environmental process or processes. They are also a critical assessment of that process, highlighting not only what we know, but also what we don't know and where the science should be heading in the years to come. Taking this approach not only increases the readability and accessibility of the paper

to our readers, but it will also enhance its scientific impact on environmental science.

Mastering the skills needed to write a good scientific review also pays dividends when writing up the literature review featured in the introduction of primary-research papers. The same skills are needed by researchers to do a better job of linking research objectives to the knowledge gaps and research needs brought to light by a critical review of the relevant literature and then ensuring that their research design, methods, results, and conclusions follow logically from these objectives (Maier, 2013).

There exist a number of papers devoted to instruction on how to write a good review paper. Among the most useful for scientific reviews, in my estimation, are those by Torraco (2016, 2005) and Pautasso (2013). Many of the steps detailed in the instructional list that follows are found in these papers. More detailed review-writing instructions that walk a prospective author through each component of the paper (title, abstract, introduction, etc.) can be found in Mayer (2009).

Steps for Writing a Review Paper

Before You Begin to Search or Write

1 Clearly define the topic. Typically, a review writer works in the related field and already has a good knowledge of the topic, but not necessarily. Choose a review topic that has sufficient material behind it to warrant a review but define the topic narrowly enough to maintain a clear focus and curtail potential review materials to a practical volume.

2 Know your audience. For most of the journals published by ACSESS, your audience mainly comprises researchers and other science-savvy readers who may themselves be experts on the topic or at least can bring their own expertise and experience to bear. A good rule of thumb is don't underestimate your readers' intelligence but don't overestimate their understanding of the topic.

3 Choose the style of review you want to write. Different journals may have different requirements. For example, JEQ is typically not interested in traditional-style reviews that are merely historical and descriptive. For this journal, a narrative (qualitative) style is acceptable if it is critical and synthetic, and we also invite a systematic style that includes meta-analysis. Whatever style and approach (see next point) you follow, don't stray.

4 Determine the approach you will take in writing the review. Identify any assumptions you will make and whether you intend to write neutrally or to take a certain position on the subject.

Carrying Out the Literature Review

1. Determine the breadth of the literature review you intend to conduct. A systematic review is comprehensive in its source selection, whereas a representative review gathers from a narrower range of sources that represents the whole.

2. Determine which keywords and databases (e.g., BioOne, Google Scholar, JSTOR, Scopus, and Web of Science) you will use to conduct the literature search. Create a matrix to organize which combinations of databases and keywords produce usable sources. Use this information when writing up the method for your review.

3. While you are gathering sources, read at least the abstracts and carry out a scoping exercise that helps you set the boundaries of the topic and the literature you intend to review. Keeping notes as you go of key features of each source will help you later when you lay down the structure of the paper.

4. Develop a rationale and system for keeping or discarding certain sources. In doing so, though, avoid researcher/writer and journal bias, which may push what you hope is a neutral review in a certain direction. Include this information when writing up the method for your review.

5 Look for previous reviews on the topic. Use them as a springboard for your own review, critiquing the earlier reviews, adding more recently published material, and possibly exploring a different perspective. Exploit their references as another entry point into the literature.

6 Be as current as possible but don't overlook historical sources that are still relevant.

7 Use a reference management system, such as EndNote, Papers, or Mendeley, to organize, store, and retrieve references. Even if you can't access a source right away, include it in your Reference list so you can keep track of it and look for it later.

8 If you hope to carry out a meta-analysis, ensure that a sufficient number of primary-research papers of similar methodology and comparable datasets are available to enable reliable analysis.

Writing the Review

1 Good scientific writing tells a story, so come up with a logical structure for your paper, with a beginning, middle, and end. Use appropriate headings and sequencing of ideas to make the content flow and guide readers seamlessly from start to finish. It might be worthwhile to structure the review around a guiding theory, a set of competing models, or a point of view about the topic (Torraco, 2005).

2 Include a section to describe the method you used to gather, sort, analyze, and synthesize the information you present in the review. This section is comparable to the Methods section of a scientific-research paper in that it should enable the reader to conduct the same kind of review, obtain similar results, and draw similar conclusions (apart from where interpretations may differ).

3 Conduct a critical analysis of the literature. This may involve "deconstruction" of the topic into its basic elements, such as "history and origins of the topic, its main concepts, the key relationships through which the concepts interact, research methods, [and] applications of the topic" (Torraco, 2005). The final product of critical analysis is a critique, which offers meaningful commentary on the research covered in the review terms of:

- strengths and key contributions
- deficiencies, omissions, inaccuracies, and errors
- gaps (aspects that are missing, incomplete, or poorly represented)
- variations in research design and methodology
- conflicting findings or conclusions and controversies surrounding the topic
- expanded understanding in view of new research developments

4 Beyond summarizing the literature you are using, set out from the beginning to synthesize the knowledge in a way that offers new understanding of the topic. Torraco (2016, p. 421) lists five forms of synthesis for integrative literature reviews, and there are undoubtedly others:

- research agenda—gives direction for future research
- taxonomy (or other conceptual classification of constructs)—often used to classify previous research
- alternative models or conceptual frameworks—offers a new way of thinking about the topic, taken directly from the critical analysis presented in the review
- meta-analysis—A summary of comparable studies generated quantitatively through statistical analysis
- metatheory—The formulation of new theory that crosses theoretical domains

5 Stay focused and on point. This will make your paper concise and cogent. A good preliminary exercise to achieve this is to create a mind map, story board, or other conceptual organizer for the whole paper.

6 Create charts, graphs, or other visuals that synthesize information effectively. These may include the conceptual organizer from No. 5 above.

7 Lay a strong foundation for future research by describing new developments, identifying factors that have shaped and continue to shape research in this field, and proposing an approach to resolve controversies.

8 Make multiple revisions to ensure clear, concise, and understandable writing.

9 Seek several reviewers and commentators to review the paper before submission. This step can be expected to expose weaknesses in the structure of the paper and the writing style, invite additional content, and perhaps garner conflicting views that you would do well to face early.

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